

DOCUMENT RESUME

ED 185 336

CE 024 816

AUTHOR Dugger, William E.; And Others
 TITLE Industrial Arts Education Competency Catalogs for Communication Technology, Materials and Processes Technology, Power and Transportation Technology.
 INSTITUTION Old Dominion Univ., Norfolk, Va. Dept. of Industrial Arts Education.
 SPONS AGENCY Virginia State Dept. of Education, Richmond. Trade and Industrial Education Service.
 PUB DATE 79
 NOTE 144p.; For related documents see CE 024 815-818.
 EDRS PRICE MF01/PC06 Plus Postage.
 DESCRIPTORS Communications: Competence: Competency Based Education: *Industrial Arts: Manufacturing: *Minimum Competencies: Power Technology: Secondary Education: *Skill Analysis: Skill Development: Teaching Guides
 IDENTIFIERS Virginia

ABSTRACT

Three competency catalogs of tasks for industrial arts programs are presented. These include catalogs in Communications Technology, Materials and Processes Technology, and Power and Transportation Technology. The purpose of each catalog is to establish a basis for program content selection and criterion levels from which one may measure to see if individual learners have achieved minimal competence. Each catalog begins with an introduction, format description, course description, course goals, and suggested topical outline. The remainder of the catalog is comprised of task statements. Each task follows a typical format that includes the following sections: (1) Area of Competence, which identifies the industrial arts course for which the task was prepared; (2) Content/Concept, which identifies the sub-area with which the particular task is associated; (3) Task, which identifies the knowledge, skills, or attitudes that the learner should possess after instruction; (4) Criterion Referenced Measure, which provides the means of determining whether the learner can successfully perform the task; and (5) Performance Goals, which identifies sub-tasks that lead to the development of the knowledge, skills, and attitudes identified in the task. (LPA)

 * Reproductions supplied by EDRS are the best that can be made *
 * from the original document. *

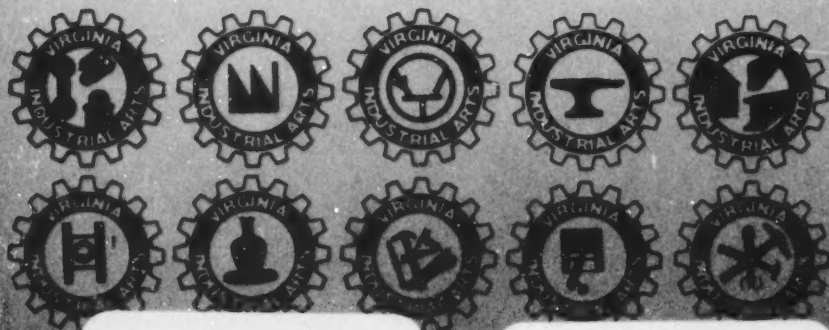
Industrial Arts Education Competency Catalogs For

communication technology

materials and processes
technology

power and transportation
technology

ED185336



U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY.

"PERMISSION TO REPRODUCE THIS
MATERIAL HAS BEEN GRANTED BY

Harry L. Smith

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)."

Industrial Arts Education Service
Department of Education
Commonwealth of Virginia
Richmond, VA 23216

1979

John M. Ritz David I. Joyner
Project Co-Directors

This Project Is Supported by Funds
Appropriated Under
PL 94-482 for FY-1979
For Industrial Arts Curriculum Development
Funded Through the
Department of Vocational and Industrial Arts Education
Old Dominion University
Norfolk, Virginia

As required by federal laws and regulations, the Virginia Department of Education does not discriminate on the basis of sex, race, color, religion, handicapping conditions, or national origin in employment or in its educational programs and activities.

Developed by the Department of Vocational and Industrial Arts Education, Old Dominion University, Norfolk, VA 23508. Old Dominion University is an affirmative action/equal opportunity institution.

PREFACE

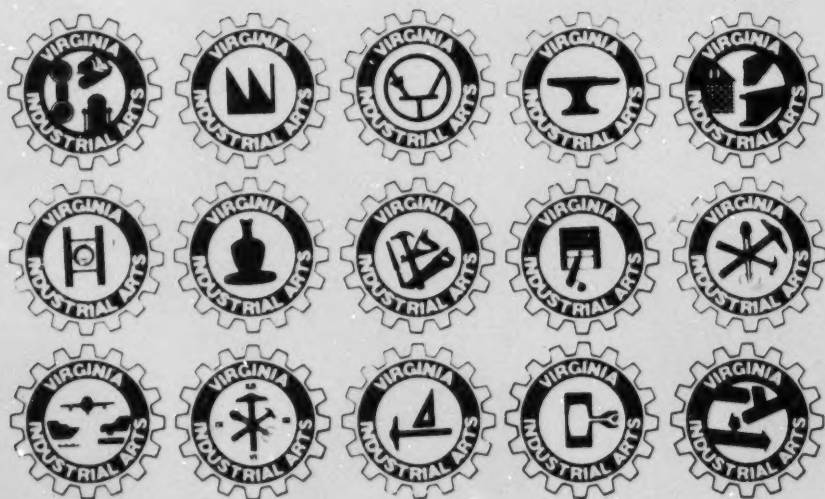
In today's complex society, learners need to be prepared to experience situations they will encounter in the future. Consequently, news media presentations have evidenced an intense and genuine concern on the part of government and the citizenry about the quality of American education. Accountability has become an accepted rule in an effort to improve the process of education for the benefit of learners. A national movement to improve education and its accountability has produced several important developments - among these is Competency-Based Instruction.

Competency-based instruction is a means of education based upon the identification and attainment of prespecified, role relevant outcomes. To be competent implies that a learner be well qualified and possess certain abilities and qualities within a specified content area. That is, competency based instruction is a system designed to develop prespecified knowledge, skills, and attitudes in learners who are enrolled in an educational program.

Included within this publication are three competency catalogs of tasks for Virginia's Industrial Arts Program. These include catalogs on Communication Technology, Materials and Processes Technology, and Power and Transportation Technology. The purpose of these are to establish a basis for program content selection and criterion levels from which one may measure to see if individual learners have achieved a minimal level of competence through study in a particular course. In this manner a means to improve education and its accountability to the citizenry can be designed based upon the identification and attainment of prespecified outcomes for the industrial arts content area.

A CATALOG OF TASKS
FOR
COMPETENCY-BASED INSTRUCTION
IN

Communication Technology



Industrial Arts Education Service
Department of Education
Commonwealth of Virginia
Richmond, Virginia 23216
1979

This Catalog of Tasks
Was Prepared At
Virginia Polytechnic Institute and State University
By
William E. Dugger, Project Director
David W. Marsh, Research Assistant

Members of the Advisory Committee
Who Supervised This Curriculum Development
Project Included

David I. Joyner, Co-Chairman, Old Dominion University
John M. Ritz, Co-Chairman, Old Dominion University
Marshall O. Tetterton, State Department of Education
Ricardo V. Gaeta, Old Dominion University
Charles L. Smith III, Buena Vista
Louis O. Beatty, York County
Bruce O. Watson, Henrico County
Henry L. Wyatt, Lynchburg
Henry M. Wheeler, Henrico County

For further information concerning this
competency catalog write to
Industrial Arts Education Service
Division of Vocational Education, Department of Education
P.O. Box 6Q, Richmond, Virginia 23216

INTRODUCTION

In the summer of 1977, The Industrial Arts Curriculum K-12 was introduced. This plan outlined the preferred courses, course sequences, and purposes which should be addressed in Virginia industrial arts programs. However, the model curriculum plan did not establish exact knowledge, skills, and attitudes which all learners should possess as they exit particular programs.

The purpose of the following competency catalog of tasks is to establish a basis for program content selection and criterion levels from which one may measure to see if individual learners have achieved a minimal level of competence through study in a particular course. In this manner a means to improve education and its accountability to citizenry can be designed based upon the identification and attainment of prespecified outcomes for the industrial arts content area. Although this catalog is designed and presented in a sequential order of task statements, it does not mean that it must be structured into local programs in this order. Individual instructors may choose to restructure the sequence of competency tasks to meet local needs.

In preparing this catalog considerable research and validation was undertaken to specify those minimal tasks which every learner enrolling in the course should be able to perform. The format of this and other catalogs includes the following areas: area of competence, content/concept, task, criterion referenced measure, and performance guides. The area of competence identifies the industrial arts course for which the particular task was prepared. Content/concept identifies the sub-area with which the particular task is associated. The task is the knowledge, skills or attitudes which the learner should possess after instruction in the industrial arts class. Criterion references measures are means to identify if the learner can successfully perform the stated task and finally, performance guides are sub-tasks which lead to the development of the knowledge, skills and attitudes

identified in the tasks. These areas are illustrated in Table 1. It should be noted that performance objectives have been omitted from the catalogs of tasks. This was done to allow individual instructors to develop objectives they see necessary to meet the local learning environment.

In Table 2 is identified the location of this course in the total program of industrial arts for Virginia. Other competency catalogs are contained in this publication and the remaining catalogs may be obtained from the Industrial Arts Education Service, Division of Vocational Education, Department of Education, P.O. Box 6Q, Richmond, Virginia 23216.

FORMAT DESCRIPTION

AREA OF COMPETENCE: Identifies the industrial arts course for which the particular task was prepared.

CONTENT/CONCEPT: Identifies the sub-area which the particular task is associated.

TASK: Identifies the knowledge, skills, or attitudes which the learner should possess after completing instruction in the industrial arts class.

CRITERION REFERENCED MEASURE: The means to identify if the learner can successfully perform the stated task.

PERFORMANCE GUIDES: Identifies sub-tasks which lead to the development of the knowledge, skills, and attitudes identified in the tasks.

TABLE 1

The Industrial Arts Curriculum

Level	Goal	Program
Elementary School	Learning Reinforcement	Industrial Arts activities integrated within the elementary curriculum
Middle or Junior High School	Orientation and Exploration	Exploring Technology Modern Industry Construction Manufacturing
High School	Technical	■ Communication Technology - Materials and Processes Technology - Power and Transportation Technology - Architectural Drawing - Basic Technical Drawing - Electricity and Electronics - Energy and Power - Engineering Drawing - Graphic Communications - Metals Technology - Woods Technology
	Personal Enrichment	General Industrial Arts Industrial Crafts

TABLE 2



COMMUNICATION TECHNOLOGY

Course Code
8415

COURSE DESCRIPTION:

Students study visual and telecommunication systems, processes and organization. Learning experiences include the study of numerous technical developments such as the radio, television, offset printing and photography. Basic technical skills are developed in drafting, graphic arts, photography and telecommunications.

COURSE GOALS:

Experiences and activities of this INDUSTRIAL ARTS course will enable the student to:

- 1.1 recognize basic reproduction processes used in industrial applications of visual communications.
- 1.2 use properly the nomenclature associated with visual and telecommunications systems.
- 1.3 assess abilities and interests as they relate to careers in communications technology.
- 1.4 explain the needs for a systematic and safe procedure in setting up experimental circuits and servicing equipment.
- 1.5 demonstrate the interrelationship of drafting, graphic arts, photography and telecommunications.
- 2.1 produce copies using image reproduction processes generally found in business and industry.

- 2.1 demonstrate effective means of conveying an idea using presentation materials.
- 2.2 produce drawings following standardized procedures capable of being used to produce a product.
- 3.1 discuss critically the merits and weaknesses of an existing industrial design.
- 3.2 exhibit insight into the application of technology to problems of electronic design and servicing.
- 3.3 describe the importance of following regulations in the installation of electrical components.

SUGGESTED TOPICAL OUTLINE:

- I. Introduction to Communications Technology
 - A. Communications systems
 - B. Model of Communications
- II. Telecommunications
 - A. Relationship to communications model
 - B. Processes
 - C. One-way communications systems
 - D. Two-way communications systems
 - E. Telecommunications careers
- III. Drafting Communications
 - A. Relationship to communications model
 - B. Equipment familiarization
 - C. Techniques
 - D. Types of mechanical drawing
 - E. Size description
 - F. Reproduction
 - G. Drafting careers
- IV. Graphic Communications
 - A. Relationship to communications model
 - B. Layout and design

- C. Image generation
 - D. Photo-conversion: principles of process photography
 - E. Image carrier preparation
 - F. Image transfer
 - G. Binding, finishing and packaging
 - H. Graphic communications careers
- V. Continuous Tone Photography
- A. Relationship to communications model
 - B. Black and white still photography
 - C. Cinematography
 - D. Photography careers
- VI. Communications Enterprise and the Industrial Arts Student Association
- A. Production
 - B. Management
 - C. Sales
 - D. Advertising
 - E. Personnel
 - F. Financial
 - G. Supplies and equipment

TASK # 1

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Communications Systems

TASK: Define Communication.

CRITERION REFERENCED MEASURE: Define the term communication as the act of transferring information from a source to a destination.

PERFORMANCE GUIDES:

1. Read text definition of communication.
2. Participate in class discussion on aspects of communication.
3. Formulate a class definition of communication.
4. Discuss the historical development of communications.

TASK # 2

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Communications Systems

TASK: Compare and Contrast Ways in Which People Communicate with Other People.

CRITERION REFERENCED MEASURE: List various ways people communicate and compare each to the other: gestures, sign language, actions, talking, drawings, beating of drums, written telegraph, visual and printed word.

PERFORMANCE GUIDES:

1. Read assignment on the various communication methods and procedures.
2. Participate in class discussion on communication.
3. Research and write a report on people-to-people communications.
4. Compare the different ways of communication.
5. Discuss the effects communication has on society.

TASK # 3

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Communication Systems

TASK: Describe ways in Which Humans Communicate with Machines.

CRITERION REFERENCED MEASURE: Identify several ways that humans communicate by using machines.

PERFORMANCE GUIDES:

1. Read text on man-machine communication.
2. Participate in class discussion on man-machine communication.
3. List examples on ways that humans communicate using machines.

TASK # 4

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Communication Systems

TASK: Describe ways in Which Machines Communicate with Machines.

CRITERION REFERENCED MEASURE: Recall various ways in which machines communicate with machines, such as computers, thermostats, and timers.

PERFORMANCE GUIDES:

1. Review text on machine/machine communication.
2. Participate in class discussion on various machine/machine communication.
3. Describe several machine communications relays.
4. List other forms of communications.

TASK # 5

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Communications Model

TASK: Describe Communications Models.

CRITERION REFERENCED MEASURE: Demonstrate a knowledge of a communications model including information, sources, channel, signal transmitter, receiver, interference, feedback, and destination.

PERFORMANCE GUIDES:

1. Review material explaining a communications model.
2. Participate in class discussion on a communications model.
3. Sketch a diagram of a communication model and explain each step.

TASK # 6

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Communications Model

TASK: Apply a Communications Model to the Areas of Telecommunications, Graphic Arts, Photography and Drafting.

CRITERION REFERENCED MEASURE: List examples of the communication model and describe the necessary component of telecommunications graphic arts, photography, and drafting.

PERFORMANCE GUIDES:

1. Review text material on a communication model.
2. Draw models in each area of telecommunications, graphic arts, photography, and drafting and add the necessary components used to complete each step.
3. Complete a class assignment dealing with a model and its application and use.

TASK # 7

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Telecommunications: One-way
Communication Systems

TASK: Describe Examples of One-way Communications
Systems.

CRITERION REFERENCED MEASURE: Recall several
examples of one-way communications systems
such as public radio, TV, telegraph, and
printed materials.

PERFORMANCE GUIDES:

1. Participate in class discussions on types of one way communication.
2. List as many types of one way communications as possible.
3. Draw a block diagram of a one-way communication system and label each block.

TASK # 8

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Telecommunications: One-way
Communication Systems

TASK: Describe the Basic Principles of Radio
Operations.

CRITERION REFERENCED MEASURE: Discuss the basic
principles of radio operations including
transmitting and receiving.

PERFORMANCE GUIDES:

1. Review text material relating to radio operation.
2. Conduct audio visual and/or field trips relating to the transmitting and receiving of radio communications.
3. Outline the equipment and steps involved in radio communications.
4. Perform selected experiments on transmitting and receiving.

TASK # 9

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Telecommunications: One-way
Communication Systems

TASK: Describe the Basic Principle of the
Phonograph Operation.

CRITERION REFERENCED MEASURE: Discuss the basic
principle of phonographic operation and the
functions of the major components of a
phonograph.

PERFORMANCE GUIDES:

1. Read the text materials concerning the phonographic operation and the functions of the basic parts.
2. Examine a phonograph and its major parts.
3. View a sketch or outline of the phonographic operation.
4. Participate in class discussion on the phonographic processes.
5. Draw a block diagram of the major parts of a phonograph and label each block.
6. Perform selected experiments on pressure sources of electricity including the observation of waveforms on an oscilloscope.

TASK # 10

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Telecommunications: One-way
Communication Systems

TASK: List the Basic Principle of Television
Operation.

CRITERION REFERENCED MEASURE: Describe the principle
behind the operation of a television.

PERFORMANCE GUIDES:

1. Read text materials concerning television operation.
2. View audio visuals and/or field trips on television operations.
3. Participate in class discussion on television operation.
4. Label the block diagrams of a T.V. receiver.

TASK # 11

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Telecommunications: One-way
Communication Systems

TASK: Develop Skills in Using a Video Tape Recorder.

CRITERION REFERENCED MEASURE: Use a video tape
recorder to make a class presentation.

PERFORMANCE GUIDES:

1. Read text materials on video tape operation.
2. Observe demonstrations on video taping.
3. Review manual/instruction on equipment.
4. Develop a video tape presentation.

TASK # 12

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Telecommunications: One-way
Communication Systems

TASK: Develop Skills in Using a Tape Recorder.

CRITERION REFERENCED MEASURE: Use a tape recorder to
make a class presentation.

PERFORMANCE GUIDES:

1. Read text materials on the use of the tape recorder.
2. Review manual/instructions on the recorder.
3. View demonstrations on the correct use of the recorder.
4. Perform selected assignments using the tape recorder.

TASK # 13

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Telecommunications: Two-way Communications Systems

TASK: List Two-way Communications Systems.

CRITERION REFERENCED MEASURE: Recall examples of two-way communications systems including telephone, speech, CB radio.

PERFORMANCE GUIDES:

1. Read text material on types of two-way communications.
2. Participate in class discussion on various types of two-way communications.
3. Complete a list of two-way communications systems.
4. Draw a block diagram of a two-way communication system and label each block.

TASK # 14

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Telecommunications: Two-way
Communications Systems

TASK: Discuss the Basic Principle of Telegraph
Operation.

CRITERION REFERENCED MEASURE: Describe the basic
principle of telegraph operation.

PERFORMANCE GUIDES:

1. Read text unit on telegraph operations.
2. Participate in class discussion on telegraph operations.
3. View audio visual and/or field trip related to telegraph operations.
4. List the various functions of telegraph operations.
5. Perform selected experiments on telegraph construction and operations.

TASK # 15

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Telecommunications: Two-way
Communications Systems

TASK: Discuss the Basic Principles of Telephone
Operation.

CRITERION REFERENCED MEASURE: Describe the basic
elements of telephone operation including
message encoding techniques, transmitting
elements, carrying ensurement, receiving
elements, and message decoding techniques.

PERFORMANCE GUIDES:

1. Review text materials on the functions of telephone operations.
2. Participate in class discussion on modern telephone operations.
3. View audio visual and/or field trip related to telephone operations.
4. Develop a list of steps necessary in telephone communications.
5. Perform selected experiments on the basic elements of telephone operations.

TASK # 16

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Telecommunications: Two-way
Communications Systems

TASK: Discuss how Satellites are Used in Communication.

CRITERION REFERENCED MEASURE: Describe ways that
satellites are used in two-way communications
systems.

PERFORMANCE GUIDES:

1. Read text information on satellite uses.
2. Discuss in class various uses of satellite in communications.
3. Develop a list of several uses of satellite in communications.

TASK # 17

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Telecommunications: Two-way
Communications Systems

TASK: Discuss how Computers are Used in Communication.

CRITERION REFERENCED MEASURE: Describe how computers
are used in two-way communications.

PERFORMANCE GUIDES:

1. Read text material on computer use.
2. Participate in class discussion on computer uses.
3. View audio visuals and/or field trips relating the use of computers.
4. Explain the difference between analog and digital computers.
5. Draw a block diagram and list the basic components of a computer system.
6. Perform selected experiments on logic circuits.

TASK # 18

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Drafting Communications: Equipment Familiarization

TASK: Develop Skills in Using Basic Drafting Equipment.

CRITERION REFERENCED MEASURE: Demonstrate skill in the use of the following drafting equipment: T-square, 30° -60° triangle, 45° triangle, compass, drawing board, architects scale, protractor, erasing shield and pencil.

PERFORMANCE GUIDES:

1. Review text on correct use of equipment.
2. Observe teacher demonstration on correct use of drafting equipment.
3. View audio visual presentations on correct uses of drafting equipment.
4. Perform selected assignments using drafting equipment.

TASK # 19

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Drafting Communications: Techniques

TASK: Develop Skills in Freehand Drawing.

CRITERION REFERENCED MEASURE: Demonstrate skills in making a freehand drawing.

PERFORMANCE GUIDES:

1. Review practice methods of sketching in textbooks.
2. View audio visual presentations on free-hand drawing.
3. Observe teacher demonstrations on steps involved in completing a freehand drawing.
4. Perform selected sketching and freehand drawings.

TASK # 20

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Drafting Communications: Techniques

TASK: Develop Skills in Line Drawing.

CRITERION REFERENCED MEASURE: Demonstrate skill in producing a line drawing.

PERFORMANCE GUIDES:

1. Review text material on procedures followed in producing acceptable line drawing.
2. View audio visual presentations and demonstrations on correct line drawing techniques.
3. Perform selected assignments on line drawings.

TASK # 21

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Drafting Communications: Types of Mechanical Drawing

TASK: Develop Skills in Mechanical Drawing.

CRITERION REFERENCED MEASURE: Demonstrate skills in making different types of mechanical drawings including orthographic projections, pictorial drawings, and schematics.

PERFORMANCE GUIDES:

1. Review text units on orthographic, pictorial, and schematic drawings.
2. View audio visuals and/or demonstrations on construction of orthographic, pictorial, and schematic drawings.
3. Perform selected assignments on orthographic projections, pictorials, and schematic drawings.

TASK # 22

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Drafting Communications: Reproduction

TASK: Discuss Drawing Reproduction Methods Including Tracing, Blueprints, and Diazo Copies.

CRITERION REFERENCED MEASURE: Describe reproduction methods such as tracing, blueprints, and diazo copies.

PERFORMANCE GUIDES:

1. Read text on each type of mechanical drawing reproduction method.
2. Observe a demonstration on drawing reproduction methods.
3. View the results of mechanical drawing reproduction methods.
4. Review the manual/instruction.
5. Perform selected assignments on drawing reproduction.

TASK # 23

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Graphic Communications: Image Generation

TASK: List the Main Categories of Image Generation.

CRITERION REFERENCED MEASURE: Recall the main categories of hot and cold image generation including strike on, photo composition, continuous tone photography, hand set type, machine set type.

PERFORMANCE GUIDES:

1. Participate in class discussion on image generation.
2. List and compare the type of image generation.
3. Perform selected assignments on image generation.

TASK # 24

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Graphic Communications: Photo-conversion - Principles of Process Camera

TASK: Develop Line Copy Film.

CRITERION REFERENCED MEASURE: Demonstrate skills in developing film using proper darkroom procedures.

PERFORMANCE GUIDES:

1. Review text content on film developing techniques.
2. Observe teacher demonstration on developing film.
3. List the steps in developing film.
4. Perform selected assignments on developing film.

TASK # 25

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Graphic Communications: Image Generation

TASK: Develop Skills in Using Clip-Art, Strike-On Image, Photo Composition and Free Hand Composition.

CRITERION REFERENCED MEASURE: Demonstrate skill in using clip art, strike-on image, photo composition, and free hand composition in generating images.

PERFORMANCE GUIDES:

1. Read text material or clip-art, strike-on image, photo composition, and free hand composition.
2. Observe teacher demonstrations on clip-art, strike-on image, photo composition, and free hand composition.
3. Perform selected assignments using clip-art, strike-on image, photo composition, and free hand composition.

TASK # 26

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Graphic Communications: Layout
and Design

TASK: Develop Skill in Layout and Design.

CRITERION REFERENCED MEASURE: Develop a layout using
thumbnail sketches, rough layout, comprehensive
layout, and mechanical layout.

PERFORMANCE GUIDES:

1. Read text assignments on thumbnail sketches, rough layout, comprehensive layout, and mechanical layout.
2. Observe samples of thumbnail sketches, rough layout, comprehensive layout, and mechanical layout.
3. Perform selected assignments on thumbnail sketches, rough layout, comprehensive layout, and mechanical layout.

TASK # 27

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Graphic Communications: Image Transfer

TASK: Compare and Contrast the Image Transfer Principles.

CRITERION REFERENCED MEASURE: List and describe various ways in which letterpress, lithography, screen printing, electrostatic, and gravure methods of image transfer differ and are similar to each other.

PERFORMANCE GUIDES:

1. Review text information on different methods of image transfer.
2. Participate in class discussions on various types of image transfer.
3. View finished samples of different methods of printing.
4. Make a list of similarities and differences of the different methods of printing.
5. Perform selected assignments of different methods of printing.

TASK # 28

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Graphic Communications: Image Transfer

TASK: Develop Skills in Operating the Offset-Lithography Press.

CRITERION REFERENCED MEASURE: Demonstrate skill in using the offset press to make printed copies.

PERFORMANCE GUIDES:

1. Read the text unit on the operation of the offset press.
2. Review the manual/instructions on the equipment.
3. Observe teacher demonstration on the setup and operation of the press.
4. List the operational steps necessary to operate the press.
5. Perform selected assignments using the offset press.

TASK # 29

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Graphic Communications: Image Transfer

TASK: Develop Skills in Screen Process Printing.

CRITERION REFERENCED MEASURE: Design and produce a screen process printing product.

PERFORMANCE GUIDES:

1. Review text on the printing process for different types of stencils.
2. Observe teacher demonstration on screen process printing production.
3. List the steps involved in screen process printing production.
4. Perform selected assignments on screen process printing production.

TASK # 30

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Continuous Tone Photography: Black and White Still Photography

TASK: Describe the Relationships of ASA Ratings, F-stops, and Shutter Speeds to the Amount of Light Reaching the Film.

CRITERION REFERENCED MEASURE: Demonstrate the relationship of ASA rating, f-stops, and shutter speeds on the amount of light reaching the film by taking photographs.

PERFORMANCE GUIDES:

1. Read text material concerning ASA rating, f-stops, and shutter speeds.
2. Participate in class discussions on ASA ratings, f-stops, and shutter speeds.
3. Label the major parts of the camera.
4. Observe audio visual and/or demonstration on the relationship of ASA, f-stops, and shutter speed to light received.
5. Perform selected assignments on film exposure.

TASK # 31

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Continuous Tone Photography: Black and White Still Photography

TASK: Develop Skills in the Use and Care of a Camera.

CRITERION REFERENCED MEASURE: Take photographs with a camera using black and white film.

PERFORMANCE GUIDES:

1. Observe teacher demonstration on the proper care and use of a camera.
2. Review of the camera manual.
3. Perform selected assignments using a camera.

TASK # 32

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Continuous Tone Photography: Black and White Still Photography

TASK: Develop Skills in Making and Processing Black and White Prints and Enlargements.

CRITERION REFERENCED MEASURE: Expose and process black and white photographic paper to obtain pictures.

PERFORMANCE GUIDES:

1. Review text on paper developing and printing.
2. Observe teacher demonstration on exposing and processing black and white prints and enlargements.
3. Perform selected assignments on exposing and processing black and white prints and enlargements.

TASK # 33

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: Communications Enterprise:
Advertising

TASK: Develop Skills in Making Newspaper and Magazine Ads, Radio and Television Commercials, Posters, and Decorative Packaging.

CRITERION REFERENCED MEASURE: Demonstrate a knowledge of procedure in developing newspaper and magazine ads, radio/television commercials, posters, and decorative packaging as related to the area of communication technology.

PERFORMANCE GUIDES:

1. Participate in class discussion on developing newspaper and magazine ads, radio and television commercials, posters and decorative packaging.
2. Review the various media used for advertising.
3. Perform selected job assignments on advertising.

TASK # A.I.A.S.A.

AREA OF COMPETENCE: Communication Technology

CONTENT/CONCEPT: In Class Industrial Arts Student Association

TASK: Participation (involvement) in a democratic organization with activities using course content.

CRITERION REFERENCED MEASURE: Participate with other students in organized activities using industrial resources, leadership or followership, service or enterprise projects and recognition for workmanship.

PERFORMANCE GUIDES:

1. Organize class into personnel system for democratic decision making and leader/follower development.
2. Invite speakers to class and use resources of industry and technology from the community.
3. Carry out worthy group activities and projects to improve or serve school or community.
4. Operate an enterprise system to produce item of economic value.
5. Encourage competition in areas of course to motivate and recognize achievement.

NOTE: These performance guides are expanded in the publication titled Student Association Activities in Industrial Arts Instruction available from the Industrial Arts Service, Virginia Department of Education, Richmond, Virginia 23216. 46

A CATALOG OF TASKS
FOR
COMPETENCY-BASED INSTRUCTION
IN

Materials and Processes Technology



Industrial Arts Education Service
Department of Education
Commonwealth of Virginia
Richmond, Virginia 23216
1979

This Catalog of Tasks
Was Prepared At
Norfolk State University
Department of Teacher Education
By
James A. Jacobs, Project Director
Albert Moore, Research Assistant
Lacy Webb, Research Assistant

Members of the Advisory Committee
Who Supervised This Curriculum Development
Project Included

David I. Joyner, Co-Chairman, Old Dominion University
John M. Ritz, Co-Chairman, Old Dominion University
Arvid Van Dyke, Virginia State College
Paul Cummings, Newport News
Peter Fulcer, Loudoun County
Russell G. Louis, Virginia Polytechnic Institute and
State University
Leo Gibbs, Portsmouth
Charles A. Pinder, Virginia Polytechnic Institute and
State University

For further information concerning this
competency catalog write to
Industrial Arts Education Service
Division of Vocational Education, Department of Education
P.O. Box 60, Richmond, Virginia 23216

INTRODUCTION

In the summer of 1977, The Industrial Arts Curriculum K-12 was introduced. This plan outlined the preferred courses, course sequences, and purposes which should be addressed in Virginia industrial arts programs. However, the model curriculum plan did not establish exact knowledge, skills, and attitudes which all learners should possess as they exit particular programs.

The purpose of the following competency catalog of tasks is to establish a basis for program content selection and criterion levels from which one may measure to see if individual learners have achieved a minimal level of competence through study in a particular course. In this manner a means to improve education and its accountability to citizenry can be designed based upon the identification and attainment of prespecified outcomes for the industrial arts content area. Although this catalog is designed and presented in a sequential order of task statements, it does not mean that it must be structured into local programs in this order. Individual instructors may choose to restructure the sequence of competency tasks to meet local needs.

In preparing this catalog considerable research and validation was undertaken to specify those minimal tasks which every learner enrolling in the course should be able to perform. The format of this and other catalogs includes the following areas: area of competence, content/concept, task, criterion referenced measure, and performance guides. The area of competence identifies the industrial arts course for which the particular task was prepared. Content/concept identifies the sub-area with which the particular task is associated. The task is the knowledge, skills or attitudes which the learner should possess after instruction in the industrial arts class. Criterion references measures are means to identify if the learner can successfully perform the stated task and finally, performance guides are sub-tasks which lead to the development of the knowledge, skills and attitudes

identified in the tasks. These areas are illustrated in Table 1. It should be noted that performance objectives have been omitted from the catalogs of tasks. This was done to allow individual instructors to develop objectives they see necessary to meet the local learning environment.

In Table 2 is identified the location of this course in the total program of industrial arts for Virginia. Other competency catalogs are contained in this publication and the remaining catalogs may be obtained from the Industrial Arts Education Service, Division of Vocational Education, Department of Education, P.O. Box 6Q, Richmond, Virginia 23216.

FORMAT DESCRIPTION

AREA OF COMPETENCE: Identifies the industrial arts course for which the particular task was prepared.

CONTENT/CONCEPT: Identifies the sub-area which the particular task is associated.

TASK: Identifies the knowledge, skills, or attitudes which the learner should possess after completing instruction in the industrial arts class.

CRITERION REFERENCED MEASURE: The means to identify if the learner can successfully perform the stated task.

PERFORMANCE GUIDES: Identifies sub-tasks which lead to the development of the knowledge, skills, and attitudes identified in the tasks.

TABLE 1

The Industrial Arts Curriculum

Level	Goal	Program
Elementary School	Learning Reinforcement	Industrial Arts activities integrated within the elementary curriculum
Middle or Junior High School	Orientation and Exploration	Exploring Technology Modern Industry Construction Manufacturing
High School	Technical	- Communication Technology ■ Materials and Processes Technology - Power and Transportation Technology - Architectural Drawing - Basic Technical Drawing - Electricity and Electronics - Energy and Power - Engineering Drawing - Graphic Communications - Metals Technology - Woods Technology
	Personal Enrichment	General Industrial Arts Industrial Crafts

TABLE 2



MATERIALS AND PROCESSES TECHNOLOGY

Course Code
8475

COURSE DESCRIPTION:

Students study industrial-technical materials and processes as they fabricate usable products. Learning experiences include machine and automated processes for the fabrication, analysis or testing of metals, woods, plastics, ceramics and natural and synthetic materials. Specially recommended course for the future technician, engineer, or scientist.

COURSE GOALS:

Experiences and activities of this INDUSTRIAL ARTS course will enable the student to:

- 1.1 recall the basic nature, classifications, and properties of woods, metals, plastics, ceramics, composites and other materials.
- 1.2 explain the industrial processes employed to fabricate woods, metals, ceramics, plastics, and composites into functional items.
- 1.3 identify career paths for a selected career field in materials and processes technology.
- 1.4 investigate and analyze industrial materials on the ecological balance, the utilization and conservation of natural resources, and the recycling capabilities of industrial materials and products.

- 2.1 demonstrate problem-solving techniques in the selection of suitable materials and processes for fabricating various products.
- 2.2 demonstrate proficiency in the proper and safe operation of metalworking, woodworking, plastics, ceramics, and measurement and testing tools and machines.
- 2.3 select and compare the specific industrial applications and operations necessary for the production in quantity of a particular product made of plastics, metals, wood, ceramics, and composites.
- 3.1 determine the potential career opportunities in materials and processes technology in the year 2000.
- 3.2 appreciate the knowledge, skills and aptitudes necessary for different levels of employment in fields related to materials and processes technology.
- 3.3 exhibit good work habits, respect for and cooperation with associates.

***SUGGESTED TOPICAL OUTLINE:**

- I. Introduction to Materials
 - A. Nature
 - 1. Microstructure
 - 2. Macrostructure
 - B. Classification
 - 1. Metals
 - 2. Polymers
 - a. Woods
 - b. Plastics
 - c. Elastomers
 - d. Others (e.g. adhesive and protective coatings)

- C. Basic Properties
 - D. Testing
 - 1. Destructive
 - 2. Non-destructive
 - II. Introduction to Materials Processing
 - A. Measurement
 - B. Separating
 - C. Forming
 - D. Joining
 - E. Conditioning
 - F. Inspection and quality control
 - III. Materials and Humanity
 - A. Materials consumption
 - B. Resources, Energy, Ecology, and Society
 - IV. Student Activities
 - A. Team activities
 - B. Individual activities
 - C. Contract work
 - D. Community involvement
 - V. Evaluation and Analysis
 - VI. The Industrial Arts Student Association
-

* Integration of topics is suggested, e.g. when working with plastics cover its nature, classification, and processing.

TASK # 1

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Safety Procedures

TASK: Perform Laboratory Experiments using Accepted Procedures.

CRITERION REFERENCED MEASURE: Using appropriate standards, demonstrate maintenance of shop safety equipment and safe operation and set ups of machinery when developing a project or experiment.

PERFORMANCE GUIDES:

1. Supplied with the appropriate standards, demonstrate safe working habits at all times when conducting in class activities and individual projects.
2. Perform a laboratory experiment using accepted safety procedures.
3. Learn the rules of conduct and general safety involving machines.
4. Pass written safety test.
5. Pass proficiency tests on operation of machines and equipment.

TASK # 2

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Safety Procedures

TASK: Determine the Proper Clothing and Protective Devices for Activities Involving Materials and Processes.

CRITERION REFERENCED MEASURE: List and describe proper clothing and protective devices set forth by the accepted standards in wood, metal, plastics and ceramics activities.

PERFORMANCE GUIDES:

1. Read related units in texts on safety pertaining to each of the following activities: woods, metals, plastics and ceramics.
2. Identify the proper clothing and protective devices for activities involving wood, metal, plastics, and ceramics set forth by accepted standards.
3. Elect a safety director to point out unsafe practices in each class.

TASK # 3

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: First Aid

TASK: Discuss First Aid Procedures Employed in
Laboratory Accidents.

CRITERION REFERENCED MEASURE: Describe first aid
procedures employed in laboratory accidents
for the following: burns, cuts, and shock.

PERFORMANCE GUIDES:

1. Listen to the instructor's lecture on first aid procedures employed in laboratory accidents.
2. Observe instructor's demonstration of the different types of first aid employed for burns, cuts, shock, etc.
3. Perform various types of first aid procedures with fellow students acting as victims.

TASK # 4

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Nature of Materials

TASK: Explain the Basic Structure of Atoms and Ions.

CRITERION REFERENCED MEASURE: Describe and develop a
model atom structure.

PERFORMANCE GUIDES:

1. Give a definition of the following words:
 - a. nucleus
 - b. electrons
 - c. valence
 - d. protons
 - f. ions
2. Make a three dimensional sketch, or construct a model using styrofoam balls, representing an atom.
3. List the three types of atomic bonds and give one example of the use of each in common materials.

TASK # 5

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Nature of Materials

TASK: Identify the Sources and Methods Used in
Processing Raw Materials.

CRITERION REFERENCED MEASURE: Describe and list the
sources and methods of mining, refining,
harvesting, and processing raw material.

PERFORMANCE GUIDES:

1. Read given assignments.
2. Listen to instructor's lecture concerning the processing of raw materials.
3. Visit a material processing plant.
4. View a film presentation on processing of raw materials.
5. Develop a research paper on one of the following topics: mining, refining, or harvesting.

TASK # 6

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Microstructure - Macrostructure

TASK: Relate Microstructure and Macrostructure to
the Make Up of Industrial Materials.

CRITERION REFERENCED MEASURE: List, identify, and
sketch the formation of crystal boundaries as
individual crystals grow in their respective
dimensions.

PERFORMANCE GUIDES:

1. Give an example of microstructure and macrostructure for each of the main classes of materials: polymers, metals, ceramics, and composites.
2. Define the following terms:
 - a. matter
 - b. material
 - c. substance
 - d. compound
 - e. mixture
 - f. solution
 - g. solid
 - h. homogeneous
 - i. organic compound
3. Illustrate, using a pencil sketch, the formation of crystal boundaries as individual crystals grow independently in all three dimensions.

TASK # 7

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Classification (Metals)

TASK: Explain the Properties and Behavior of Metal
in Terms of its Atomic and Crystalline
Structure.

CRITERION REFERENCED MEASURE: Illustrate and describe
the behavior of metal in terms of its atomic
and crystalline structure.

PERFORMANCE GUIDES:

1. Illustrate (using a pencil sketch), elastic deformation and plastic deformation and give everyday examples of where each is desirable and undesirable.
2. List four types of defects in the microstructure of metal.
3. Describe the purpose of:
 - a. cooling curve and
 - b. phase diagram.
4. Name three processes for strengthening metals.

TASK # 8

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Classification (Polymers)

TASK: Describe the Basic Structure of a Polymer.

CRITERION REFERENCED MEASURE: Identify, describe, and sketch the basic structure of a polymer.

PERFORMANCE GUIDES:

1. Describe the polymer structure of woods, plastics, elastomers, leathers, and fibers.
2. Illustrate, using a pencil sketch, bond lengthening and bond straightening.
3. Define and give an example of thermo-plastics and thermosets.
4. Label a broad range of polymer materials that are available to industry.

TASK # 9

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Classification (Ceramics)

TASK: Specify the Nature, Properties, and
Ingredients of Ceramics.

CRITERION REFERENCED MEASURE: Examine the properties
of ceramic materials using a packet of
experiments provided by the instructor and
list the conclusions of each experiment.

PERFORMANCE GUIDES:

1. Examine physical properties of ceramics and state the component structures.
2. Give an example of a ceramic which possesses a very high melting point and one which is extremely hard.
3. Explain why ceramics are extremely hard and brittle and have very high melting points.
4. Display various ceramics to illustrate products and properties.

TASK # 10

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Classification (Composites)

TASK: Design and Construct a Project of Composite which would Illustrate the Advantage and Purposes of Composites.

CRITERION REFERENCED MEASURE: Design and construct a project of composite material utilizing its characteristic advantages.

PERFORMANCE GUIDES:

1. Give three advantages of composites.
2. Recall how composites provide the optimum combination of different materials for a particular application in industry.
3. Name four examples of composites.
4. Recognize where composite materials are used in industrial applications.
5. Design a project employing composites.
6. Build projects of composite materials.

TASK # 11

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Properties of Materials

TASK: Determine how to Increase Corrosion Resistance.

CRITERION REFERENCED MEASURE: Identify and recognize
the different problems of corrosion and
recall measures for preventing corrosion.

PERFORMANCE GUIDES:

1. Demonstrate, under laboratory conditions, the problem of corrosion/oxidation on metals.
2. Observe insinstances of corrosion in objects.
3. Recall and identify measures for preventing corrosion such as protective coatings, pickling, etc.
4. List or find pictures of products with resistive coatings.
5. Use protective coatings in project construction.

TASK # 12

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Properties of Materials

TASK: Explain what is Meant by Electrical Properties.

CRITERION REFERENCED MEASURE: Explain and describe the electrical properties of conductivity and resistance of selected materials.

PERFORMANCE GUIDES:

1. Differentiate between electrical conductivity properties and resistivity properties.
2. Give three examples of nonmetallic materials which are good insulators used in your home.
3. Give two examples of good conductors and semiconductors.
4. Explain what is meant by dielectric strength.
5. Measure electrical resistance in various metals.

TASK / 13

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Properties of Material

TASK: Describe Thermal Properties of Materials.

CRITERION REFERENCED MEASURE: List examples of
thermal effects on materials.

PERFORMANCE GUIDES:

1. Explain what is meant by the "coefficient of thermal expansion" and "thermal conductivity".
2. Conduct experiment to compare thermal properties of various materials.

TASK # 14

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Properties of Materials

TASK: Describe and Conduct Tests on Mechanical
Properties of Materials.

CRITERION REFERENCED MEASURE: Recall and illustrate
the following properties of materials: fatigue
properties, creep strength, impact strength,
flexural strength, ductility, plasticity,
malleability, elasticity, and hardness-brittleness.

PERFORMANCE GUIDES:

1. Draw illustrations showing elongation and compression.
2. Explain plastic deformation and elastic deformation.
3. Draw a stress-strain diagram and label it for:
 - a. Elastic range
 - b. Yield point
 - c. Ultimate strength
 - d. Breaking point
4. Apply the principles of the following mechanical properties by matching each to a test which measures the property or by giving an example of where the property is important.

TASK # 15

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Material Testing

TASK: Classify Tests as Destructive or Nondestructive.

CRITERION REFERENCED MEASURE: Develop a list of destructive and nondestructive tests and demonstrate at least one of each test.

PERFORMANCE GUIDES:

1. Name four types of destructive tests.
2. List four techniques of nondestructive testing.
3. List advantages of nondestructive testing.
4. List disadvantages of nondestructive testing.
5. Choose and perform a destructive or non-destructive test.

TASK # 16

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Measurement

TASK: Apply the System International (SI) of Metric Measurement.

CRITERION REFERENCED MEASURE: Develop a project(s) using the system international as the unit of measurement.

PERFORMANCE GUIDES:

1. State the advantages of the metric system.
2. Learn the three main metric units - meter, liter, and gram.
3. Measure various quantities of materials using SI and label and check the measurements.

TASK # 17

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Forming

TASK: Describe the Major Forming Processes.

CRITERION REFERENCED MEASURE: Identify and list major forming processes such as casting, forging, extrusion, drawing, bending, rolling, powder metallurgy, spinning, molding, and thermo-forming.

PERFORMANCE GUIDES:

1. Show films from industry.
2. Form plastic, metals, ceramics, woods, and composites by various techniques.
3. Discuss and/or demonstrate casting, forging, extrusion, drawing, bending, rolling, powder metallurgy, spinning, molding, and thermo-forming.
4. Produce projects or products from the above processes.

TASK # 18

AREA OF COMPETENCE: Materials and Processes Technology

CONTENT/CONCEPT: Conditioning

TASK: Recall Reasons for Conditioning Materials.

CRITERION REFERENCED MEASURE: Recall and demonstrate at least two methods for conditioning polymers, metals, ceramics, and composites.

PERFORMANCE GUIDES:

1. Describe some of the measures used in conditioning materials including heat treating, curing, painting, peening, plating, and glazing.
2. Recall and demonstrate methods for conditioning metals.
3. Explain the effect of conditioning as it relates to the texture and appearance of some materials.
4. Explain the effect conditioning has on corrosion.

TASK # 19

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Conditioning

TASK: Select and Apply Appropriate Finishes.

CRITERION REFERENCED MEASURE: Analyze and demonstrate the various finish coating conditioning processes including spraying, brushing, rolling, dipping, dyeing, calendar coating, electrodeposition, oxidcoating, and enameling.

PERFORMANCE GUIDES:

1. Define the various finish coating combining processes such as spraying, brushing, rolling, dipping, dyeing, calendar coating, electrodeposition, oxidcoating, and enameling.
2. Observe instructor's lecture/demonstration and media presentations depicting the various combining processes.
3. Analyze and demonstrate the various conditioning methods through the finishing of various products meeting your individual needs or as assigned by the instructor.

TASK # 20

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Conditioning

TASK: List and Perform Conditioning Processes on
Wood.

CRITERION REFERENCED MEASURE: Perform exercises on
conditioning processes of wood including
using abrasives, stains, penetrating finishes,
surface finishes, waxes and polishes, and
apply a conditioning process to a wood
product.

PERFORMANCE GUIDES:

1. Observe demonstrations on conditioning processes.
2. Read information provided on conditioning processes.
3. List two types of wood conditioning observed in your school.
4. Perform a series of exercises that display the conditioning processes of abrasives, stains, penetrating finishes, surface finishes, waxes, and polishes.
5. Apply a conditioning process to a product or project.

TASK # 21

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Conditioning

TASK: Recall Thermal Conditioning Processes on
Metals.

CRITERION REFERENCED MEASURE: Thermally condition
metals using at least two of the various
processes.

PERFORMANCE GUIDES:

1. Study the following conditioning processes:
 - a. Tempering
 - b. Hardening
 - c. Annealing
 - d. Normalizing
 - e. Carbonizing
 - f. Casehardening
2. Select and perform thermal conditioning processes through assigned projects.
3. Discuss all of the above thermal conditioning processes.

TASK # 22

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Combining

TASK: List and Perform Techniques of Combining
Wood.

CRITERION REFERENCED MEASURE: Produce a product or
project using various combining processes
including joinery, adhesives, and mechanical
fasteners.

PERFORMANCE GUIDES:

1. Explain the use of joinery, adhesives, and mechanical fasteners.
2. Observe demonstrations and lectures on combining processes of joinery, adhesives, and mechanical fasteners.
3. Perform exercises or produce products using combining processes.
4. Review charts and displays to determine the most applicable combining processes to employ in projects.

TASK # 23

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Combining

TASK: Describe and Perform Combining Processes by
Mixing.

CRITERION REFERENCED MEASURE: Identify, define, and
demonstrate the various combining processes
by mixing including beating, agitation, and
atomization.

PERFORMANCE GUIDES:

1. Study as many combining processes as possible to include beating, agitation, and atomization.
2. Demonstrate each of the combining processes by mixing: beating, agitation, and atomization.
3. Choose the appropriate combining method whenever a combining process is needed.

TASK # 24

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Combining

TASK: List and Perform Techniques for Combining Metals.

CRITERION REFERENCED MEASURE: Identify the methods of combining including alloying, electroplating, galvanizing, enameling, felting, welding, brazing, pressing and bonding and select the most appropriate one(s) for metal projects.

PERFORMANCE GUIDES:

1. Study as many combining processes as possible to include alloying, electroplating, galvanizing, enameling, felting, welding, brazing, pressing and bonding.
2. Demonstrate as many combining process techniques on metal as possible.
3. Choose the appropriate combining method whenever a combining process of metal is needed.
4. Gather objects for display showing combining processes.
5. Summarize reasons for combining metals.

TASK # 25

AREA OF COMPETENCE: Materials and Processes
Technology.

CONTENT/CONCEPT: Combining

TASK: Recall Reasons for Combining Metals.

CRITERION REFERENCED MEASURE: List reasons for
combining metals.

PERFORMANCE GUIDES:

1. Study and familiarize yourself with the reasons for combining metals.
2. Summarize reasons for combining metals.
3. Invite a guest speaker to address the class on the combining of metals.
4. View films on combining of metals.

TASK # 26

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Separating

TASK: List and Perform Techniques for Separating
Wood.

CRITERION REFERENCED MEASURE: Identify, define, and
perform separation processes (sawing,
drilling, turning, planing) which will
culminate in a student or instructor designed
product or project.

PERFORMANCE GUIDES:

1. Observe demonstrations, lectures,
and individual instruction on the
separation processes of sawing, drilling,
turning, and planing.
2. Pass safety and performance tests on
separation techniques.
3. Plan and develop a product using
a minimum of four separation processes.
4. Identify various separation processes
including sawing, drilling, turning and
planing.
5. Build projects or products using separation
processes in wood.

TASK # 27

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Separating

TASK: List and Demonstrate Separating Processes of Metal.

CRITERION REFERENCED MEASURE: Recall and perform the various separation process involved in metal working including sawing, screening, crushing, milling, magnetizing, absorbing, turning, machining, shaping, drilling, boring, broaching, grinding, shearing, etching, burning, and punching.

PERFORMANCE GUIDES:

1. Identify and define the following separating processes: sawing, screening, milling, magnetizing, grinding, crushing, absorbing, turning, machining, shaping, drilling, boring, broaching, shearing, etching, burning, and punching.
2. Describe the above separation processes.
3. Perform selected separation operations through projects.

TASK # 28

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Separating

TASK: Recall and Perform Separation Processes
with Plastics.

CRITERION REFERENCED MEASURE: Recall and demonstrate
the various separating processes (sawing,
cutting, and drilling) through the creation
of plastic products.

PERFORMANCE GUIDES:

1. Define the various separating processes
such as: sawing, cutting, and drilling.
2. Read given assignments and observe
lecture/demonstration presentations by
instructor.
3. Recall and demonstrate the various
separating processes through the
development of a plastic project.

TASK # 29

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Separating

TASK: List and Perform Separation Processes with
Ceramics.

CRITERION REFERENCED MEASURE: Identify, define, and
demonstrate the various separating processes
of ceramics including shearing and shaping.

PERFORMANCE GUIDES:

1. Identify and define the various separating processes in ceramics including shearing and shaping.
2. Observe demonstrations on the various separation processes in ceramics.
3. Develop projects using the various separating processes in ceramics.

TASK # 30

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Manufacturing Processes

TASK: Explain the Process by which Products are
Evolved from the Research and Development
Stage through Manufacturing and Sales.

CRITERION REFERENCED MEASURE: Analyze and compile a
list of processes involved in the research and
development stage through manufacturing and
sales of a product.

PERFORMANCE GUIDES:

1. Discuss research and development in manufacturing and sale of a product.
2. List the steps involved in the final production and sale of a product.
3. Develop an in class corporation with active role playing by students assuming various positions.

TASK / 31

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Production

TASK: Describe the Purpose of Manufacturing
Production.

CRITERION REFERENCED MEASURE: Describe and define
the purpose of manufacturing production
of goods.

PERFORMANCE GUIDES:

1. Define "manufacturing production".
2. State the purpose of manufacturing
production.
3. Relate these factors to the production
process.
 1. Cost
 2. Time
 3. Quality product
4. Organize an in class corporation to
produce a product.

TASK # 32

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Quality Control

TASK: Describe the Purpose of Inspection and
Quality Control.

CRITERION REFERENCED MEASURE: Give reasons why
inspections are made at manufacturing sites
and state reasons why quality control is
important.

PERFORMANCE GUIDES:

1. Develop a list of reasons why inspections are made in manufacturing production.
2. Inspect a finished product which has been manufactured through the process of machining.
3. Prepare a discussion on the importance of quality control.
4. View a film related to quality control.

TASK # 33

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Studying Materials and Processes

TASK: Summarize the Importance of a Knowledge of
Materials and Processes for Consumer use.

CRITERION REFERENCED MEASURE: Compile a list of
reasons showing the importance of knowledge
of materials and processes in being a good
consumer.

PERFORMANCE GUIDES:

1. Discuss the importance of materials including woods, metals, plastics, and ceramics.
2. Develop written or oral reports on "The Importance of Materials and Processes in my Daily Life".
3. Prepare a pamphlet on consumer topics for distribution in the school and community as service project.

TASK # 34

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Studying Materials and Processes.

TASK: Recount Issues Related to Resources, Energy, Ecology, and Society as they are Effected by Materials and Processes.

CRITERION REFERENCED MEASURE: Familiarize yourself with the issues such as resources, energy, ecology and society as they are effected by materials and their different processes.

PERFORMANCE GUIDES:

1. Study and familiarize yourself with the available resources on social/cultural issues.
2. Familiarize yourself with current activities in energy development, ecology concern, and society attitudes toward present and future materials and their processes.
3. Clip news stories and bring to class for discussion.
4. Prepare bulletin boards on current issues related to materials.

TASK # 35

AREA OF COMPETENCE: Materials and Processes Technology

CONTENT/CONCEPT: Materials and Processes Technology

TASK: Gain an Appreciation for the Importance of Technological Developments related to Materials and Processes Technology.

CRITERION REFERENCED MEASURE: Compile a list of reasons showing the importance of technological advancements in materials and processes.

PERFORMANCE GUIDES:

1. Discuss the importance of technological development in and related to materials and processes.
2. Compile a list of reasons favoring the importance of technological developments.
3. Present an oral or written report on "the Importance of Technological Advancement in Materials and Processes".

TASK # 36

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Industrial Technology Careers

TASK: Evaluate the Plastics, Metals, Woods, Composites, and Ceramics Related Careers in Industrial Technology.

CRITERION REFERENCED MEASURE: Develop an awareness of the career occupations available in the areas of plastics, metals, woods, composites, and ceramics.

PERFORMANCE GUIDES:

1. Disseminate information on related careers in plastics, metals, woods, composites, and ceramics.
2. Perform interviews, job surveys, and job evaluations on related careers to materials and processes.
3. Record and evaluate job data on information cards.
4. Discuss the various careers and occupations selected (career goals).
5. Invite speakers from materials industries to discuss career opportunities.

TASK # 37

AREA OF COMPETENCE: Materials and Processes
Technology

CONTENT/CONCEPT: Industrial Technology Careers

TASK: Describe the Members of an Engineering Team
and Summarize how they Interact.

CRITERION REFERENCED MEASURE: Identify the basic
structure of an engineering team and describe
its members.

PERFORMANCE GUIDES:

1. Identify members of an engineering team including designers, engineers, supervisors, scientists, craftsmen, technicians, and technologists.
2. Listen to instructor lecture on the structure of an engineering team.
3. Conduct an occupational analysis of various members of the engineering team.
4. Study the Occupational Outlook Handbook related to positions in engineering.
5. Organize in class engineering teams to perform enterprising or service projects.

TASK # A.I.A.S.A.

AREA OF COMPETENCE: Materials and Processes Technology

CONTENT/CONCEPT: In Class Industrial Arts Student Association

TASK: Participation (involvement) in a democratic organization with activities using course content.

CRITERION REFERENCED MEASURE: Participate with other students in organized activities using industrial resources, leadership or followership, service or enterprise projects and recognition for workmanship.

PERFORMANCE GUIDES:

1. Organize class into personnel system for democratic decision making and leader/follower development.
2. Invite speakers to class and use resources of industry and technology from the community.
3. Carry out worthy group activities and projects to improve or serve school or community.
4. Operate an enterprise system to produce item of economic value.
5. Encourage competition in areas of course to motivate and recognize achievement.

NOTE: These performance guides are expanded in the publication titled Student Association Activities in Industrial Arts Instruction available from the Industrial Arts Service, Virginia Department of Education, Richmond, Virginia 23216.

A CATALOG OF TASKS
FOR
COMPETENCY-BASED INSTRUCTION
IN

Power and Transportation Technology



Industrial Arts Education Service
Department of Education
Commonwealth of Virginia
Richmond, Virginia 23216
1979

This Catalog of Tasks
Was Prepared At
Old Dominion University
Department of Vocational and Industrial Arts Education
By
Walter F. Deal III, Project Director
Robert P. Quigley, Research Assistant

Members of the Advisory Committee
Who Supervised This Curriculum Development
Project Included

David I. Joyner, Co-Chairman, Old Dominion University
John M. Ritz, Co-Chairman, Old Dominion University
Thomas A. Hughes, State Department of Education
William Sorrell, Prince William County
Kenneth E. Williams, Hampton
Robert A. Backlund, Chesapeake
T. David Ayers, Virginia State College
Steven Wence, Loudoun County

For further information concerning this
competency catalog write to
Industrial Arts Education Service
Division of Vocational Education, Department of Education
P.O. Box 6Q, Richmond, Virginia 23216

INTRODUCTION

In the summer of 1977, The Industrial Arts Curriculum K-12 was introduced. This plan outlined the preferred courses, course sequences, and purposes which should be addressed in Virginia industrial arts programs. However, the model curriculum plan did not establish exact knowledge, skills, and attitudes which all learners should possess as they exit particular programs.

The purpose of the following competency catalog of tasks is to establish a basis for program content selection and criterion levels from which one may measure to see if individual learners have achieved a minimal level of competence through study in a particular course. In this manner a means to improve education and its accountability to citizenry can be designed based upon the identification and attainment of prespecified outcomes for the industrial arts content area. Although this catalog is designed and presented in a sequential order of task statements, it does not mean that it must be structured into local programs in this order. Individual instructors may choose to restructure the sequence of competency tasks to meet local needs.

In preparing this catalog considerable research and validation was undertaken to specify those minimal tasks which every learner enrolling in the course should be able to perform. The format of this and other catalogs includes the following areas: area of competence, content/concept, task, criterion referenced measure, and performance guides. The area of competence identifies the industrial arts course for which the particular task was prepared. Content/concept identifies the sub-area with which the particular task is associated. The task is the knowledge, skills or attitudes which the learner should possess after instruction in the industrial arts class. Criterion references measures are means to identify if the learner can successfully perform the stated task and finally, performance guides are sub-tasks which lead to the development of the knowledge, skills and attitudes

identified in the tasks. These areas are illustrated in Table 1. It should be noted that performance objectives have been omitted from the catalogs of tasks. This was done to allow individual instructors to develop objectives they see necessary to meet the local learning environment.

In Table 2 is identified the location of this course in the total program of industrial arts for Virginia. Other competency catalogs are contained in this publication and the remaining catalogs may be obtained from the Industrial Arts Education Service, Division of Vocational Education, Department of Education, P.O. Box 6Q, Richmond, Virginia 23216.

FORMAT DESCRIPTION

AREA OF COMPETENCE: Identifies the industrial arts course for which the particular task was prepared.

CONTENT/CONCEPT: Identifies the sub-area which the particular task is associated.

TASK: Identifies the knowledge, skills, or attitudes which the learner should possess after completing instruction in the industrial arts class.

CRITERION REFERENCED MEASURE: The means to identify if the learner can successfully perform the stated task.

PERFORMANCE GUIDES: Identifies sub-tasks which lead to the development of the knowledge, skills, and attitudes identified in the tasks.

TABLE 1

The Industrial Arts Curriculum

Level	Goal	Program
Elementary School	Learning Reinforcement	Industrial Arts activities integrated within the elementary curriculum
Middle or Junior High School	Orientation and Exploration	Exploring Technology Modern Industry Construction Manufacturing
High School	Technical	Communication Technology Materials and Processes Technology ■ Power and Transportation Technology Architectural Drawing Basic Technical Drawing Electricity and Electronics Energy and Power Engineering Drawing Graphic Communications Metals Technology Woods Technology
	Personal Enrichment	General Industrial Arts Industrial Crafts

TABLE 2



POWER AND TRANSPORTATION TECHNOLOGY

Course Code
8445

COURSE DESCRIPTION:

Students survey the many broad sources of energy and power utilized in power and transportation systems. Instruction includes: (1) how energy is converted into power; (2) how power is transmitted and controlled; and (3) how power is utilized through mechanical, fluid and electrical devices. Career opportunities are explored in power and transportation fields. Students build projects, conduct experiments and repair mechanical devices such as small engines, electric motors and outboard motors.

COURSE GOALS:

Experiences and activities of this INDUSTRIAL ARTS course will enable the student to:

- 1.1 recall how energy is converted, transmitted, controlled and applied to transportation systems.
- 1.2 describe the basic operating principles of heat engines and how they can be applied to transportation systems.
- 1.3 identify occupational preparation programs available in the high school and community college related to power and transportation technology.
- 1.4 use properly the nomenclature associated with mechanical, fluid and electrical devices.

- 1.5 critically discuss how power is utilized through mechanical, fluid and electrical devices.
- 2.1 demonstrate safe practices in working with power systems, tools and equipment.
- 2.2 exhibit the ability to tune-up a one cylinder four cycle engine.
- 2.3 construct basic fluid power circuits.
- 3.1 demonstrate a willingness to exhibit efficient use of time.
- 3.2 exhibit a willingness to use good work habits of orderliness, cleanliness, and care of property.

SUGGESTED TOPICAL OUTLINE:

- I. Introduction to Power and Transportation Technology
 - A. Safety
 - B. Occupational Information
 - C. Industrial Arts Student Organization
- II. Applications of Power in Transportation Systems
 - A. What is Transported
 - B. Where and How it is Transported
 - C. Why Transport
 - D. Career Opportunities in Transportation Technology
- III. Heat Engines
 - A. Internal Combustion
 - B. External Combustion
 - C. The use of heat engines in transportation systems
 - D. Career Opportunities
- IV. Natural Sources of Power

- A. Wind
 - B. Water
 - C. Solar
 - D. Muscle
 - E. Other
 - F. The use of natural sources of power in transportation systems
 - G. Career opportunities
- V. Transmission and Control of Power
- A. Mechanical
 - B. Fluid Power
 - C. Electrical Power
 - D. How transmission and control of power is utilized in transportation systems.
- VI. Research and Development in Power and Transportation Technology
- VII. The Industrial Arts Student Association:
Community resources or services

TASK # 1.

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Introduction to Power and Transportation

TASK: Define Power.

CRITERION REFERENCED MEASURE: Define power as the conversion of energy to perform useful work.

PERFORMANCE GUIDES:

1. Read assignments on power.
2. Observe teacher presentations on power.
3. Perform energy conversion experiments.
4. Identify the six basic forms of energy:
 - a. Mechanical
 - b. Electrical
 - c. Light
 - d. Heat
 - e. Nuclear
 - f. Chemical

TASK # 2

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Introduction to Power and Transportation

TASK: Define Transportation.

CRITERION REFERENCED MEASURE: Define transportation as the movement of goods, people, and services from one point to another.

PERFORMANCE GUIDES:

1. Read assignments on transportation.
2. Observe teacher presentation on transportation.
3. View film on transportation and society.
4. Identify examples of the four general environments of transportation:
 - a. Land
 - b. Sea
 - c. Air
 - d. Space

TASK # 3

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Introduction to Power and Transportation

TASK: Develop an Understanding of Safety Practices used with Tools and Equipment in Power and Transportation Technology.

CRITERION REFERENCED MEASURE: Demonstrate knowledge of safety practices used with tools and equipment in power and transportation technology.

PERFORMANCE GUIDES:

1. Teacher presentation on safety.
2. Class discussion.
3. Participate in class activities safely.

TASK # 4

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Introduction to Power and Transportation

TASK: Develop an Awareness of Occupational and Career Opportunities Pertaining to the Areas of Power and Transportation Technology.

CRITERION REFERENCED MEASURE: List and discuss career and occupational opportunities related to the areas of power and transportation technology.

PERFORMANCE GUIDES:

1. Read assignments on career opportunities.
2. Bring in "classified employment opportunity advertisements" from the local newspaper that reflect employment opportunities in power and transportation technology.
3. Identify and discuss the following aspects of occupations in power and transportation technology:
 - a. Training required,
 - b. Working conditions,
 - c. Type of physical stamina required,
 - d. Salary or wages that may be expected, and
 - e. Advancement opportunities.

TASK # 5

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Introduction to Power and Transportation

TASK: Evaluate the Use of Research and Development in Producing Efficient Power and Transportation Systems.

CRITERION REFERENCED MEASURE: Describe how research and development in power and transportation systems may be used to develop the following characteristics of an efficient system: speed, safety, frequency of service, regularity of service, comprehensiveness, capacity, comfort, economy, and responsibility.

PERFORMANCE GUIDES:

1. Teacher presentation of research and development.
2. Teacher presentation on characteristics of an efficient transportation system.
3. Characterize various transportation systems according to efficiency.
4. Field trip to closest controlled traffic intersection.
5. Observe auto traffic flow pattern.
6. Time and record data as to dominant traffic flow.
7. Analyze data as to direction for efficiency, economy of time, and safety.

TASK # 6

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Applications of Power in Transportation Systems

TASK: Discuss Applications of Power in Transportation Systems.

CRITERION REFERENCED MEASURE: List and describe how power may be used to efficiently move goods, services, and people.

PERFORMANCE GUIDES:

1. Teacher presentation on power in transportation systems.
2. View films on:
 - a. Air terminals and travel
 - b. Truck/auto travel
 - c. Railroad travel
3. Experiment with transportation power systems in model form.

TASK # 7

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Applications

TASK: Demonstrate a Knowledge of the Uses of Control Systems Related to Power in Transportation Systems.

CRITERION REFERENCED MEASURE: List and describe the uses of control systems pertaining to power in transportation systems.

PERFORMANCE GUIDES:

1. Read assignments on control systems.
2. Teacher presentation on control systems.
3. Listen to guest speakers from air traffic control tower.
4. Establish role playing activity: air transport control tower.
5. Role playing: taxi cab radio dispatcher.
6. Discuss mechanical and electrical control systems in vehicles.

TASK # 8

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Applications

TASK: Demonstrate a Knowledge of the Applications of Transportation Support Systems Pertaining to Power in Transportation Systems.

CRITERION REFERENCED MEASURE: List and describe how transportation support systems are used in power and transportation systems.

PERFORMANCE GUIDES:

1. Read assignments on transportation support systems.
2. Participate in class discussion.
3. Define roles and participate in role-playing activity.
4. List support systems used in land, air, sea, and space travel.

TASK # 9

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Heat Engines - Internal Combustion

TASK: Explain the Operation of the Internal Combustion Two-Stroke Engine.

CRITERION REFERENCED MEASURE: Identify and describe the function of the internal combustion two-stroke engine.

PERFORMANCE GUIDES:

1. Read assignments on two-stroke internal combustion engines.
2. Participate in class discussion.
3. View models and illustrations of the internal combustion two-stroke engine.
4. Participate in small engine activity.

TASK # 10

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Heat Engines - Internal Combustion

TASK: Explain the Internal Combustion Four-Stroke Engine.

CRITERION REFERENCED MEASURE: Identify and describe the function of the four-stroke internal combustion engine.

PERFORMANCE GUIDES:

1. Read assignments on four-stroke internal combustion engines.
2. Participate in class discussion.
3. View models and illustrations of the internal combustion four-stroke engine.
4. Participate in small engine activity.

TASK # 11

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Heat Engines - Internal Combustion

TASK: Explain the Operation of the Four-Stroke Diesel Engine.

CRITERION REFERENCED MEASURE: Describe the operation and identify the major features of the four-stroke diesel engine.

PERFORMANCE GUIDES:

1. Read assignments on diesel four-stroke engines.
2. Participate in class discussion.
3. View models and illustrations of four-stroke diesel engines.
4. Participate in laboratory experiences.

TASK # 12

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Heat Engines - Internal Combustion

TASK: Explain the Function of the Wankel Rotary
Internal Combustion Engine.

CRITERION REFERENCED MEASURE: Identify and describe the
function of the Wankel rotary internal combustion
engine.

PERFORMANCE GUIDES:

1. Read assignments on Wankel rotary internal combustion engines.
2. Participate in class discussion.
3. View models and illustrations of rotary engines.
4. Perform laboratory experiments with rotary engines.

TASK # 13

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Heat Engines - Internal Combustion

TASK: Discuss the Application of Heat Engines in Transportation Systems.

CRITERION REFERENCED MEASURE: List and describe applications of heat engines in land, air, sea and space transportation systems.

PERFORMANCE GUIDES:

1. Read assignments on application of heat engines in transportation.
2. Participate in class discussion.
3. Classify vehicles according to the type of heat engines they employ.

TASK # 14

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Natural Sources

TASK: Discuss the Use of Wind as a Source of Power.

CRITERION REFERENCED MEASURE: List and describe uses of wind as a source of power with emphasis on wind generators.

PERFORMANCE GUIDES:

1. Read assignments on wind as a source of power.
2. Participate in class discussion.
3. List various uses of wind as a source of power.
4. Construct a model wind power generator.
5. List advantages and disadvantages of wind generators.

TASK # 15

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Natural Sources

TASK: Discuss Muscle Power and its Application as a Source of Power.

CRITERION REFERENCED MEASURE: Describe how muscle power can be utilized as a source of power.

PERFORMANCE GUIDES:

1. Teacher presentation on muscle power.
2. Read assignments on muscle power as a source of power.
3. Participate in class discussion.
4. Conduct simple experiments using muscle power.
5. Develop models of technical developments that have used muscle power as a source of power.

TASK # 16

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Natural Sources

TASK: Discuss the Application of Water as a Source of Power.

CRITERION REFERENCED MEASURE: Describe the application of water as a natural source of power.

PERFORMANCE GUIDES:

1. Read assignments on water as a source of power.
2. Participate in class discussion.
3. Teacher presentation on water power.
4. List examples of water as a source of power.
5. Construct examples of water wheels.

TASK # 17

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Natural Sources

TASK: Discuss the Use of Ocean Tides as a Source of Power.

CRITERION REFERENCED MEASURE: Explain the principle of using ocean tides as a source of power.

PERFORMANCE GUIDES:

1. Read assignments on ocean tides as a source of power.
2. Teacher presentation on tides as a power source.
3. Participate in class discussion of future trends and application of ocean tides as a source of power.
4. View films or models on using tides as a source of power.

TASK # 18

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Natural Sources

TASK: Discuss the Uses of Solar Energy as a Source of Power.

CRITERION REFERENCED MEASURE: Explain how solar energy may be used as a source of power.

PERFORMANCE GUIDES:

1. Read assignments on solar energy.
2. Participate in class discussion.
3. Teacher presentation on solar energy.
4. Teacher demonstration using solar cells.
5. Discuss future trends in solar energy.
6. Develop models employing solar energy as a source of power.

TASK # 19

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Natural Sources

TASK: Discuss the Uses of Geothermal Energy as a Source of Power.

CRITERION REFERENCED MEASURE: Explain the principles of using the earth's own heat as a source of power.

PERFORMANCE GUIDES:

1. Read assignments on geothermal sources of power.
2. Participate in class discussion.
3. Teacher presentation on geothermal energy.
4. View films on geothermal energy.

TASK # 20

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Natural Sources

TASK: Demonstrate a Knowledge of the Terms Finite, Replentishable, and Continuous Sources of Power.

CRITERION REFERENCED MEASURE: Contrast and compare the terms finite, replentishable, and continuous sources of power.

PERFORMANCE GUIDES:

1. Read assignments on finite, replentishable, and continuous sources of power.
2. Participate in class discussion.
3. Teacher presentation on sources of power.
4. List examples of finite, replentishable and continuous sources of power.

TASK # 21

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Mechanical

TASK: Define the Term Mechanical Power.

CRITERION REFERENCED MEASURE: Record the meaning of the term mechanical power and list various sources of mechanical power.

PERFORMANCE GUIDES:

1. Read assignments on mechanical power.
2. Participate in class discussion.
3. Teacher presentation on mechanical power.
4. List sources of mechanical power.

TASK # 22

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Mechanical

TASK: Demonstrate a Knowledge of how Mechanical Power is Transmitted.

CRITERION REFERENCED MEASURE: Describe how mechanical power is transmitted for use with emphasis on gears, pulleys, and belts.

PERFORMANCE GUIDES:

1. Read assignments on the transmission of mechanical power.
2. Participate in class discussion.
3. Teacher presentation on transmission of mechanical power.
4. Perform mechanical power experiments using gears, pulleys, and belts.
5. Design mechanisms utilizing methods of transmitting mechanical power.

TASK # 23

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Mechanical

TASK: Classify Methods of Controlling Mechanical Power.

CRITERION REFERENCED MEASURE: List and describe various methods of controlling mechanical power.

PERFORMANCE GUIDES:

1. Read assignments on the control of mechanical power.
2. Participate in class discussion.
3. List methods of controlling mechanical power.
4. Perform experiments in controlling mechanical power.

TASK # 24

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Mechanical

TASK: Describe Mechanical Power Output.

CRITERION REFERENCED MEASURE: Explain what is meant by mechanical power output and calculate mechanical power output.

PERFORMANCE GUIDES:

1. Read assignments on mechanical power output.
2. Participate in class discussion.
3. Teacher presentation on mechanical power output.
4. Participate in experiments on mechanical power output.
5. Calculate problems dealing with mechanical power output.

TASK # 25

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Mechanical

TASK: Demonstrate a Knowledge of how Mechanical Power is Used in Transportation Systems.

CRITERION REFERENCED MEASURE: Describe how mechanical power is utilized in transportation systems.

PERFORMANCE GUIDES:

1. Read assignments on the application of mechanical power in transportation.
2. Participate in class discussion on using mechanical power.
3. Teacher presentation on using mechanical power.

TASK # 26

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Fluid

TASK: Define Fluid Power

CRITERION REFERENCED MEASURE: Define the term fluid power as the generation, control, and application of smooth, effective power by means of pumped or compressed fluids (liquids or gases).

PERFORMANCE GUIDES:

1. Read assignments on fluid power.
2. Participate in class discussion.
3. Teacher presentation on fluid power.
4. Perform fluid power experiments.

TASK # 27

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Fluid

TASK: Define the Term Hydraulics

CRITERION REFERENCED MEASURE: Define the term hydraulics as the flow of liquids under various conditions and the ways of directing this flow to useful ends.

PERFORMANCE GUIDES:

1. Read assignments on hydraulics.
2. Participate in class discussions.
3. Teacher presentation on hydraulics.
4. Perform hydraulic experiment.

TASK # 28

AREA OF COMPETENCE: Power and Transportation
Technology

CONTENT/CONCEPT: Types of Power - Fluid

TASK: Define the Term Hydrodynamics.

CRITERION REFERENCED MEASURE: Define the term
hydrodynamics as fluids in motion.

PERFORMANCE GUIDES:

1. Read assignments on hydrodynamics.
2. Participate in class discussion.
3. Teacher presentation on hydrodynamics.
4. List examples of hydrodynamics in use.

TASK # 29

AREA OF COMPETENCE: Power and Transportation
Technology

CONTENT/CONCEPT: Types of Power - Fluid

TASK: Define the Term Hydrostatics.

CRITERION REFERENCED MEASURE: Define the term
hydrostatics as fluids under pressure but
not in motion (Pascal's Law).

PERFORMANCE GUIDES:

1. Read assignments on hydrostatics.
2. Participate in class discussion.
3. Teacher presentation on hydrostatics.
4. List examples of hydrostatics in use.

TASK # 30

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Fluid

TASK: Define the Term Pneumatics.

CRITERION REFERENCED MEASURE: Define the term pneumatics as the application of the properties of gases, such as pressure, density, conversion, compression, and expansion.

PERFORMANCE GUIDES:

1. Read assignments on pneumatics.
2. Participate in class discussion.
3. Teacher presentation/demonstration on pneumatics.
4. Perform pneumatic experiments.

TASK # 31

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Fluid

TASK: Discuss the Transmission of Fluid Power.

CRITERION REFERENCED MEASURE: Describe how fluid power is transmitted for utilization.

PERFORMANCE GUIDES:

1. Read assignments on the transmission of fluid power.
2. Participate in class discussion.
3. Teacher presentation on transmitting fluid power.
4. Continue fluid power experiments.

TASK # 32

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Fluid

TASK: Demonstrate a Knowledge of the Uses of Fluid Power in Transportation Systems.

CRITERION REFERENCED MEASURE: Describe the application of fluid power in transportation systems.

PERFORMANCE GUIDES:

1. Read assignments on the utilization of fluid power in transportation.
2. Participate in class discussion.
3. Perform fluid power experiments involving a complete fluid system to include:
 - a. Input
 - b. Transmission
 - c. Control
 - d. Output

TASK # 33

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Electrical

TASK: Define the Term Electricity.

CRITERION REFERENCED MEASURE: Define the term electricity as the flow of electrons along a conductor.

PERFORMANCE GUIDES:

1. Read assignments on electrical power.
2. Participate in class discussion.
3. Teacher presentation on electrical power.
4. Observe films on electrical power.

TASK # 34

AREA OF COMPETENCE: Power and Transportation
Technology

CONTENT/CONCEPT: Types of Power - Electrical

TASK: Identify Sources of Electrical Power.

CRITERION REFERENCED MEASURE: List and describe
sources of electrical power with emphasis
on solar, hydroelectric, wind, and chemical
sources.

PERFORMANCE GUIDES:

1. Read assignments on sources of electrical power.
2. Participate in class discussion.
3. List sources of electrical power.
4. Experiment with sources of electrical power.

TASK # 35

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Electrical

TASK: Describe Generators and the Generation of Electric Power.

CRITERION REFERENCED MEASURE: Identify the basic components of a generator and describe how it may be used to generate electrical power.

PERFORMANCE GUIDES:

1. Read assignments on generators.
2. Participate in class discussions.
3. Teacher presentation on electrical power generation.
4. Construct a model generator with laboratory experimental equipment.

TASK # 36

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Electrical

TASK: Demonstrate a Knowledge of How Electrical Power is Transmitted.

CRITERION REFERENCED MEASURE: Describe how electrical power is transmitted for utilization.

PERFORMANCE GUIDES:

1. Read assignments on the transmission of electrical power.
2. Teacher presentation on electrical power transmission.
3. Participate in class discussion.
4. Participate in class experiment activities or electrical power transmission.

TASK # 37

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Electrical

TASK: Discuss Methods of Controlling Electrical Power.

CRITERION REFERENCED MEASURE: List and describe methods used in the control of electric power.

PERFORMANCE GUIDES:

1. Read assignments on controlling electrical power.
2. Participate in class discussion.
3. List methods used in the control of electrical power.
4. Participate in class experiment activities on electric control.

TASK # 38

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Electrical

TASK: Define Power Loads and Electrical Power.

CRITERION REFERENCED MEASURE: Compare and contrast the terms power loads and electrical power.

PERFORMANCE GUIDES:

1. Read assignment on power loads.
2. Participate in class discussion.
3. Teacher presentation on electrical power and power loads.

TASK # 39

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Electrical

TASK: Describe the Utilization of Electrical Power in Transportation Systems.

CRITERION REFERENCED MEASURE: Discuss how electrical power is utilized in transportation systems.

PERFORMANCE GUIDES:

1. Read assignments on the utilization of electrical power in transportation.
2. Participate in class discussions.
3. Teacher presentation on useage of electrical power in transportation.
4. List various examples of the utilization of electrical power in transportation (trolleys, trains, etc.).

TASK # 40

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Nuclear

TASK: Discuss the Application of Nuclear Reaction as a Source of Power.

CRITERION REFERENCED MEASURE: Describe the utilization of nuclear reaction as a source of power with emphasis on advantages and disadvantages.

PERFORMANCE GUIDES:

1. Read assignments on nuclear power.
2. Participate in class discussion.
3. Teacher presentation on nuclear power.
4. List advantages and disadvantages of nuclear power.
5. View films on nuclear power.

TASK # 41

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Types of Power - Nuclear

TASK: Describe the Utilization of Nuclear Power in Transportation Systems.

CRITERION REFERENCED MEASURE: List examples of the utilization of nuclear power in future transportation systems.

PERFORMANCE GUIDES:

1. Read assignments on utilization of nuclear power in transportation.
2. Participate in class discussion.
3. Teacher presentation on the use of nuclear power in transportation devices.

TASK # 42

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Transportation Vehicles

TASK: List and Describe Significant Developments in the History of Transportation.

CRITERION REFERENCED MEASURE: Recall and explain significant developments that have occurred in transportation throughout history.

PERFORMANCE GUIDES:

1. Read assignments on the history of transportation.
2. View films on the history of transportation.
3. Construct models of historical development in transportation.
4. Visit museums containing transportation vehicles.
5. List vehicles and years in which they were invented.

TASK # 43

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: Future Transportation Systems

TASK: Project Developments in Transportation Systems of the Future.

CRITERION REFERENCED MEASURE: Design and construct a future transportation system.

PERFORMANCE GUIDES:

1. Research possible ideas for future transportation systems.
2. Develop drawings of future transportation systems.
3. Construct models of future transportation systems.

TASK # A.I.A.S.A.

AREA OF COMPETENCE: Power and Transportation Technology

CONTENT/CONCEPT: In Class Industrial Arts Student Association

TASK: Participation (involvement) in a democratic organization with activities using course content.

CRITERION REFERENCED MEASURE: Participate with other students in organized activities using industrial resources, leadership or followership, service or enterprise projects and recognition for workmanship.

PERFORMANCE GUIDES:

1. Organize class into personnel system for democratic decision making and leader/follower development.
2. Invite speakers to class and use resources of industry and technology from the community.
3. Carry out worthy group activities and projects to improve or serve school or community.
4. Operate an enterprise system to produce item of economic value.
5. Encourage competition in areas of course to motivate and recognize achievement.

NOTE: These performance guides are expanded in the publication titled Student Association Activities in Industrial Arts Instruction available from the Industrial Arts Service, Virginia Department of Education, Richmond, Virginia 23216. 144